CLAIMS:

1. An optical signal multiplexer/demultiplexer for bidirectional transmission and reception of optical signals through individual channels capable of working in a transmitting and receiving modes simultaneously for transmitting and receiving a plurality of optical signals of different wavelengths through each individual channel, said optical signal multiplexer/demultiplexer comprising:

   a plurality of optical prisms arranged in series and having coatings selective with respect to transmission and reflection of said optical signals of different wavelengths;

   an inlet/outlet on one side thereof and a second outlet/inlet on the other side thereof;

   said optical signal multiplexer/demultiplexer passing one of said optical signals of different wavelengths from said inlet/outlet to said outlet/inlet and from said outlet/inlet to said inlet/outlet without substantially affecting said one of said optical signals, while processing the rest of said optical signals of different wavelengths;

   said coatings comprising means for conjugation and separation of said optical signals of different wavelengths within said optical prisms.

2. The optical signal multiplexer/demultiplexer of Claim 1, wherein said plurality of optical prisms are combined into an integral unit and wherein said integral unit together with said inlet/outlet and said outlet/inlet comprise an optical module.

3. The optical signal multiplexer/demultiplexer of Claim 2, wherein said inlet/outlet comprises a first signal transmission/receiving channel, and said outlet/inlet comprises a second signal transmission/receiving channel and a third signal transmission/receiving channel, each said signal

transmission/receiving channel comprising an optical fiber having an end facing to a respective optical prism and a collimator/focusator on said end of said optical fiber, said collimator/focusator acting as an optical collimator for optical signals transmitted from each optical fiber to a respective optical prism and as an optical focusator transmitted from each optical prism to a respective optical fiber, each said optical channel having an optical path for transmitting/receiving optical signals.

4. The optical signal multiplexer/demultiplexer of Claim 3, wherein said plurality of optical prisms comprises a first optical prism and a second optical prism, said first optical prism having a first side and a second side parallel to said first side; said second optical prism having a first side and a second side and being arranged in series with said first optical prism behind said second side of said first optical prism, said first side of said second optical prism being parallel to said second side of said first optical prism and facing said second side of said second optical prism, said second side of said second optical prism being parallel to said first side of said second optical prism and facing in a direction opposite to said first optical prism;

said optical signal multiplexer/demultiplexer transmitting and receiving a first-wavelength optical signal, a second-wavelength optical signal, and a third-wavelengths optical signal;

said coatings comprising:

a first antireflective coating formed on said first side of said first optical prism on the optical path of said first-wavelength optical signal, said second-wavelength optical signal, and said third-wavelength signal, said antireflective coating being transparent to said first second-wavelength optical signal, said first and said third-wavelengths optical signal;

a second coating formed on said second side of said first optical prism and transparent to said first-wavelength optical signal and said third-wavelength

optical signal but reflective to said second-wavelength optical signal so that said second-wavelength optical signal is reflected from said second coating, while said first-wavelength optical signal and said third-wavelength optical signal pass through said second coating;

a third coating fully reflective to said second-wavelength optical signal, which is formed on said first side of said first optical prism and on an optical path of said second-wavelength optical signal reflected from said coating;

a fourth coating formed on said second side of said first optical prism and on an optical path of said second-wavelength optical signal reflected from said second coating, said fourth coating being transparent to said second-wavelength optical signal;

a fifth coating on said first side of said second optical prism which is transparent to said first-wavelength optical signal and said third-wavelength optical signal, said fifth coating being located on an optical path of said first-wavelength optical signal and said third wave-length optical signal;

a sixth coating formed on said second side of said second optical prism on an optical pass of said first-wavelength optical signal and said third wave-length optical signal, said sixth coating being transparent to said first-wavelength optical signal but being reflective to said third-wavelength optical signal, so that said first-wavelength optical signal passes through said sixth coating, while said third-wavelength optical signal is reflected from said sixth coating;

a seventh coating formed on said first side of said second optical prism on an optical path of said third-wavelength optical signal and on said optical path of said second-wavelength optical signal that passed through said fourth coating, said seventh coating being transparent to said second-wavelength optical signal, but being reflective to said third-wavelength optical signal; and

an eighth coating formed on said second side of said second optical prism on an optical path of said second-wavelength optical signal and of said third-wavelength optical signal, said eighth coating being transparent to said second-wavelength optical signal and to said third-wavelength optical signal, so that said

second-wavelength optical signal and said third-wavelength optical signal pass through said eighth coating;

said second channel being located on an optical path of said first-wavelength optical signal and said third channel being located on an optical paths of said second-wavelength optical signal and of said third optical signal.

5. The optical signal multiplexer/demultiplexer of Claim 4, further comprising a mounting base for mounting said first optical prism, said second optical prism, said first channel signal input/output unit, said second channel signal input/output unit, and said third channel signal input/output unit and for optically aligning said optical paths of said first-wavelength optical signal, said second-wavelength optical signal, and of said third-wavelength optical signal with said coatings and with said signal input/output units.

6. The optical signal multiplexer/demultiplexer of Claim 5, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said second-wavelength optical signal has a wavelength equal to about 1480 nm, and said second-wavelength optical signal has a wavelength equal to about 1310 nm.

7. The optical signal multiplexer/demultiplexer of Claim 5, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said second-wavelength optical signal has a wavelength equal to about 1310 nm, and said second-wavelength optical signal has a wavelength equal to about 780 nm.

8. The optical signal multiplexer/demultiplexer of Claim 2, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said

second-wavelength optical signal has a wavelength equal to about 1480 nm, and said second-wavelength optical signal has a wavelength equal to about 1310 nm.

9. The optical signal multiplexer/demultiplexer of Claim 3, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said second-wavelength optical signal has a wavelength equal to about 1480 nm, and said second-wavelength optical signal has a wavelength equal to about 1310 nm.

10. The optical signal multiplexer/demultiplexer of Claim 4, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said second-wavelength optical signal has a wavelength equal to about 1480 nm, and said second-wavelength optical signal has a wavelength equal to about 1310 nm.

11. The optical signal multiplexer/demultiplexer of Claim 2, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said second-wavelength optical signal has a wavelength equal to about 1310 nm, and said second-wavelength optical signal has a wavelength equal to about 780 nm.

12. The optical signal multiplexer/demultiplexer of Claim 3, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said second-wavelength optical signal has a wavelength equal to about 1310 nm, and said second-wavelength optical signal has a wavelength equal to about 780 nm.

13. The optical signal multiplexer/demultiplexer of Claim 4, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said

second-wavelength optical signal has a wavelength equal to about 1310 nm, and said second-wavelength optical signal has a wavelength equal to about 780 nm.

14. An optical signal multiplexer/demultiplexer for bidirectional transmission and reception of optical signals through individual channels capable of working in a transmitting and receiving modes simultaneously for transmitting and receiving a first-wavelength optical signal, a second-wavelength optical signal, and a third-wavelengths optical signal, said optical signal multiplexer/demultiplexer comprising:

a first optical prism having a first side and a second side parallel to said first side;

a second optical prism arranged in series with said first optical prism behind said second side of said first optical prism, said second optical prism having a first side parallel to said second side of said first optical prism and facing thereto, and a second side parallel to said first side of said second optical prism and facing in a direction opposite to said first optical prism;

a first channel signal input/output unit with a first optical beam processing unit on said first side of said first optical prism;

a second channel signal output/input unit comprising a second optical beam processing unit on said second side of said second optical prism;

a third channel signal output/input unit comprising a third optical beam processing unit on said second side of said second optical prism;

a first antireflective coating formed on said first side of said first optical prism on the optical path of said first-wavelength optical signal, said second-wavelength optical signal, and said third-wavelength signal, said antireflective coating being transparent to said first second-wavelength optical signal, said first and said third-wavelengths optical signal;

a second coating formed on said second side of said first optical prism and transparent to said first-wavelength optical signal and said third-wavelength

optical signal but reflective to said second-wavelength optical signal so that said second-wavelength optical signal is reflected from said second coating, while said first-wavelength optical signal and said third-wavelength optical signal pass through said second coating;

a third coating fully reflective to said second-wavelength optical signal, which is formed on said first side of said first optical prism and on an optical path of said second-wavelength optical signal reflected from said coating;

a fourth coating formed on said second side of said first optical prism and on an optical path of said second-wavelength optical signal reflected from said second coating, said fourth coating being transparent to said second-wavelength optical signal;

a fifth coating on said first side of said second optical prism which is transparent to said first-wavelength optical signal and said third-wavelength optical signal, said fifth coating being located on an optical path of said first-wavelength optical signal and said third wave-length optical signal;

a sixth coating formed on said second side of said second optical prism on an optical pass of said first-wavelength optical signal and said third wave-length optical signal, said sixth coating being transparent to said first-wavelength optical signal but being reflective to said third-wavelength optical signal, so that said first-wavelength optical signal passes through said sixth coating, while said third-wavelength optical signal is reflected from said sixth coating;

a seventh coating formed on said first side of said second optical prism on an optical path of said third-wavelength optical signal and on said optical path of said second-wavelength optical signal that passed through said fourth coating , said seventh coating being transparent to said second-wavelength optical signal, but being reflective to said third-wavelength optical signal; and

an eighth coating formed on said second side of said second optical prism on an optical path of said second-wavelength optical signal and of said third-wavelength optical signal, said eighth coating being transparent to said second-wavelength optical signal and to said third-wavelength optical signal, so that said

second-wavelength optical signal and said third-wavelength optical signal pass through said eighth coating;

said first channel signal input/output unit being located on an optical path of said first-wavelength optical signal, said second-wavelength optical signal, and said third-wavelength optical signal;

said second channel signal input/output unit being located on an optical path of said first-wavelength optical signal; and

said third channel signal input/output unit being located on an optical paths of said second-wavelength optical signal and of said third-wavelength optical signal.

15. The optical signal multiplexer/demultiplexer of Claim 14, wherein each said channel signal input/output unit comprises an optical fiber having an end facing a respective optical prism and a collimator/focusator on said end of said optical fiber, said collimator/focusator acting as an optical collimator for optical signals transmitted from each optical fiber to a respective optical prism and as an optical focusator for an optical signal transmitted from each optical prism to a respective optical fiber.

16. The optical signal multiplexer/demultiplexer of Claim 15, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said second-wavelength optical signal has a wavelength equal to about 1480 nm, and said second-wavelength optical signal has a wavelength equal to about 1310 nm.

17. The optical signal multiplexer/demultiplexer of Claim 15, wherein said first-wavelength optical signal has a wavelength equal to about 1550 nm, said second-wavelength optical signal has a wavelength equal to about 1310 nm, and said second-wavelength optical signal has a wavelength equal to about 780 nm.

18. A method for optical multiplexing/demultiplexing of optical signals of different wavelengths in a system of bidirectional transmission and reception, comprising the steps of:

providing an optical multiplexer/demultiplexer comprising a a plurality of optical prisms arranged in series and having coatings selective with respect to transmission and reflection of said optical signals of different wavelengths; and an inlet/outlet on one side of said multiplexer/demultiplexer with a first signal transmission/reception channel and an outlet/inlet on the other side of said multiplexer/demultiplexer with a second signal transmission/reception channel and with a third signal transmission/reception channel;

providing a bidirectional optical signal transceiver;

interrupting said system and reconnecting said system through said first signal transmission/reception channel and said second signal transmission/reception channel;

connecting said third signal transmission/reception channel with said bidirectional optical signal transceiver;

transmitting/receiving one of said optical signals of different wavelengths through said multiplexer/demultiplexer in both directions between said first signal transmission/reception channel and said second transmission/reception channel; and

multiplexing/demultiplexing the rest of said optical signals of said plurality, except said one optical signal, through said multiplexer/demultiplexer in both directions between said first signal transmission/reception channel and said third transmission/reception channel.

19. The method of Claim 18, comprising the step of combining said plurality of optical prisms, said inlet/outlet, and said outlet/inlet into an optical module.

20. The method of Claim 19, wherein said plurality of signals of different wavelength comprises a first-wavelength optical signal, a second-wavelength optical signal, and a third-wavelength optical signal, said plurality of said optical prisms comprising a first optical prism and a second optical prism arranged in series with said first optical prism, said first optical prism having a first side and a second side parallel to said first side, said second optical prism having a first side and a second side which are both parallel to said first side and said second side of said first optical prism.

21. The method of Claim 20, comprising the steps of:

providing said first side of said first optical prism with a first coating, said said second side of said first optical prism with a second coating, said first side of said first optical prism with a third coating, said second side of said first optical prism with a fourth coating, said first side of said second optical prism with a fifth coating, said second side of said second optical prism with a sixth coating, said first side of said second prism with a seventh coating, and said second side of said second optical prism with an eight coating;

passing said first-wavelength optical signal and said second-wavelength optical signal through said first antireflective coating;

passing said third-wavelength optical signal from said second signal transmission/reception channel through said eighth coating towards said seventh coating;

passing said first-wavelength optical signal through said second coating and reflecting said second-wavelength optical signal from said second coating towards said third coating;

passing said first-wavelength optical signal through said fifth coating;

passing said first-wavelength optical signal through said sixth coating to said second signal transmission/reception channel;

reflecting said second-wavelength optical signal from said third coating towards said fourth coating;

passing said second-wavelength optical signal through said fourth coating to said seventh coating;

passing said second-wavelength optical signal through said seventh coating to said eight coating;

passing said second-wavelength optical signal through said eighth coating to said third signal transmission/reception channel along the optical path of said second-wavelength optical signal which passed through said seventh coating towards said eighth coating, thus conjugating said second-wavelength optical signal and said third-wavelength optical signal, which propagate through said first optical prism and said second optical prism in mutually opposite directions;

reflecting said third-wavelength optical signal from said seventh coating towards said sixth coating, thus conjugating said first-wavelength optical signal and said third-wavelength optical signal, which propagate through said first optical prism and said second optical prism in mutually opposite directions;

passing said third-wavelength optical signal through said fifth coating and through said second coating to said fist coating, thus conjugating said first-wavelength optical signal with said second-wavelength optical signal and said third-wavelength optical signal, which propagate through said first optical prism in a direction opposite to the direction of said third-wavelength optical signal.